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# STOPPING WATER POLLUTION AT ITS SOURCE

MISA
Municipal/Industrial Strategy for Abatement

**DRAFT**

# ONTARIO'S INORGANIC CHEMICAL SECTOR - MONITORING COST ESTIMATES AND IMPLICATIONS

Environment
Ontario

Jim Bradley
Minister

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sector : monitoring cost estiates
and implications.

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# MUNICIPAL-INDUSTRIAL STRATEGY FOR ABATEMENT

# (MISA)

## DRAFT

# ONTARIO'S INORGANIC CHEMICAL SECTOR - MONITORING COST ESTIMATES AND IMPLICATIONS

Socio-Economic Section
Policy and Planning Branch

March 1989

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# REQUEST FOR COMMENTS AND SUGGESTIONS ON
# MONITORING COSTS AND THEIR IMPLICATIONS
# FOR
# ONTARIO'S INORGANIC CHEMICAL SECTOR

(DRAFT NO. 2, DATED MARCH 1989)

Comments and suggestions will be used to improve subsequent drafts of this report and related reports, both in terms of analysis, technical accuracy, and readability.

Please return this sheet and any comments to:

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Any comments are requested by: April 21, 1989

For specific comments, please cite the appropriate page and paragraph number. Please attach all comments on separate sheets.

Firm/Plant: ______________________________

Prepared by: ____________________ Title: ____________

Address: ______________________________

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______________________________

Telephone: ____________________ Date: ____________

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Thank you for your assistance.

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# ABSTRACT

- Estimates of the incremental capital and operating costs to Ontario's twenty-two inorganic chemical plants who are direct dischargers subject to MISA monitoring requirements are derived and summarized. Cost estimates include information provided by plant representatives through the Canadian Chemical Producers' Association (CCPA).

- Five key monitoring activities are identified:

  - sampling requirements
  - analytical requirements (characterization and routine analyses)
  - toxicity testing
  - flow measurement
  - reporting

- Total incremental monitoring costs are estimated to be $5.7 million. These costs are comprised of $4.5 million in incremental operating costs and $1.2 million in incremental capital costs.

- Using a confidence measure of +/- 20%, monitoring costs could vary by about +/- $1.1 million.

- If the inorganic sector plants were subject to comprehensive, across-the-board monitoring requirements instead of plant and effluent-specific requirements, their routine monitoring costs would be $19.0 million more than currently estimated. This difference represents the cost-effectiveness of the proposed monitoring regulations.

- These cost estimates are not definitive, but indicate different levels of monitoring activity and associated cost ranges.

- An analysis of financial impacts of selected financial statistics indicates that the effects are varied. Financial data are publicly available for only eight firms in the sector. Effects on individual plants cannot be easily discerned due to lack of plant-specific financial data.

# 1.0 BACKGROUND AND PURPOSE OF REPORT

## 1.1 MISA Objectives

MOE's Municipal-Industrial Strategy for Abatement (MISA) intends to achieve the "virtual elimination of toxic contaminants in municipal and industrial discharges into waterways."

MISA consists of three broad components:

1. Development and promulgation of Regulations which specify (a) contaminant monitoring requirements, and (b) effluent limits.
2. Development of these effluent limits based on "best available technology economically achievable" (BATEA) or water quality impacts.
3. Implementation of abatement programs and enforcement activities.

## 1.2 Sectors Affected by MISA

The MISA program will encompass at least 200 Ontario industrial and mining establishments which discharge contaminants directly into waterways disaggregated into nine industrial sectors:

- petroleum refining
- organic chemical manufacturing
- pulp and paper
- iron and steel
- metal mining and refining
- industrial minerals and manufacturing
- electric power generation
- inorganic chemical
- metal castings.

## 1.3 Effluent Monitoring Regulation for Ontario's Inorganic Chemical Sector

The first phase of the MISA regulatory program is the promulgation of monitoring regulations for all plants within each of the industrial sectors listed above.

Twenty firms with 22 plant locations (as of November 1, 1988) in the Inorganic Chemical sector are subject to the monitoring regulations:

1. Albright and Wilson Americas Inc. (Port Maitland)
2. Allied Chemicals Canada Inc. (Amherstburg)
3. Cabot Canada Ltd. (Sarnia)
4. C-I-L Inc. (Cornwall)
   C-I-L Inc. (Courtright)
5. Columbian Chemicals Canada Ltd. (Hamilton)
6. Cyanamid Canada Inc. - Niagara Plant (Niagara Falls)
   Cyanamid Canada Inc. - Welland Plant (Niagara Falls)
7. Explosives Technologies International (North Bay)
8. Electro Minerals (Canada) Inc. (Niagara Falls)
9. The Exolon-ESK Company of Canada Ltd. (Thorold)
10. Fiberglas Canada Inc. (Sarnia)
11. General Chemical Canada Ltd. (Amherstburg)
12. IMC Ltd. (Port Maitland)
13. Nitrochem Inc. (Maitland)
14. Norton Advanced Ceramics of Canada Inc. (Niagara Falls)
15. Partek Insulations Ltd. (Sarnia)
16. Stanchem, A Division of C-I-L Inc. (Cornwall)
17. Sulco Chemicals Limited (Elmira)
18. Union Carbide Canada Ltd. (Welland)
19. Washington Mills Limited (Niagara Falls)
20. Welland Chemical Ltd. (Sarnia)

Following are some explanatory points:

- At the end of 1985, operations at the Amherstburg complex of Allied Chemicals were split between Allied and General Chemical Canada.

- The CIL plant in Cornwall shares the same manufacturing complex with Cornwall Chemicals Ltd., a plant subject to MISA's Organic Chemical Manufacturing Monitoring Regulation.

- The IMC (International Minerals Corporation) site in Port Maitland has been shut down since 1984, and is now being used as a warehouse facility.

- While Stanchem is listed as a separate entity, it shares the same plant site as C-I-L (its parent company) in Cornwall. Since the sector monitoring regulations specify schedules for Stanchem, it will be treated as a separate plant for the purposes of this study.

The firms and plants within this "sector" were designated for the purposes of the MISA program. The plant classifications in terms of SIC codes range from:

| SIC | Description |
|---|---|
| 3399 | Carbon electrodes |
| 3571 | Abrasives industry, granular product |
| 3594 | Non-metallic mineral insulating industry |
| 3711 | Bulk inorganic chemical industry |
| 3721-29 | Chemical fertilizer industry |
| 3799 | Explosives industry |

While the SIC classifications may not place all of these firms within one category, they have been placed together for the purposes of the MISA program because they process and/or produce inorganic chemicals.

Inorganic chemical sector monitoring requirements are specified in two regulations:

1. "Effluent Monitoring - General" which specifies common sampling, analysis, toxicity testing, flow measurement, recording and reporting protocols and procedures for all MISA sectors; and

2. "Effluent Monitoring - Inorganic Chemical Sector" which defines monitoring requirements specific to this sector.

The "Effluent Monitoring - General" regulation came into force June 7, 1988 and will continue in force for each MISA sector.

The Inorganic Chemical Sector Regulation will come into force five months after it is promulgated and continue in force during the subsequent 12-month period. It will be terminated, except for some daily monitoring of parameters, at the end of this period. Further monitoring requirements will then be specified in an "Effluent Limits Compliance Regulation" for the sector, expected to be promulgated in 1992.

A description of the inorganic chemical industry in Canada and Ontario is presented in the Economic and Financial Profile of the Ontario Inorganic Chemicals Industry (Woods Gordon, 1987), and is summarized in Section 3.2 of the present study.

## 1.4 Purpose and Objectives of Present Report

The monitoring requirements that result from the MISA program will likely be costly to achieve. Cost-effectiveness and benefit-cost implications were among the factors considered in arriving at the agreed-to protocols and requirements. Desired monitoring techniques and technologies have been determined through negotiations with the Canadian Chemical Producers' Association (CCPA), which represents the sector firms, through a Joint Technical Committee (JTC).

This report is intended to present estimates of incremental costs to the inorganic chemical sector plants in Ontario of the requirements of the sector monitoring regulation. The report will present an estimate of what the costs will be under the inorganic chemical sector regulations and what the costs could be if potential costs were incurred under a more comprehensive, across-the-board set of requirements. To the extent possible, therefore, the cost-effectiveness of the proposed inorganic chemical sector monitoring requirements have been examined in the present study.

This report also provides estimates of the impacts of the monitoring costs on certain financial indicators on this sector, and where possible, on individual firms or plants.

This investigation is part of the economic assessment component of the MISA program. The economic rationale, purpose and elements of the economic component of the program are discussed in the report "Economic Information Needs and Assessments for Developing MISA Monitoring and Abatement Requirements" (Ontario, March 1987).

## 1.5 Cost Estimation Method

In general, two types of incremental costs of monitoring exist, one-time capital expenditures and potentially recurring operating expenses.

Normally, capital expenses are depreciated over several years so that the full capital cost is not deducted in any single year. Moreover, capital costs are usually calculated over an annual basis. However, since the MISA monitoring regulations are to be in force for only 12-months, all operating and capital costs are assumed to be incurred in that single year. This results in a conservative over-estimate of sectoral cost impacts.

In this report, capital and operating costs have been estimated for each monitoring function at each plant. Capital costs include costs incurred for equipment installations which may have continuing value.

Cost estimation includes the determination of activities and items which are required to implement each monitoring function, together with the use of simplifying assumptions where necessary. Estimates of costs of certain activities were supplied by industry sources, and through the auspices of the Canadian Chemical Producers' Association. These estimates have been verified where possible.

Cost estimates are based on specifications in the regulations.

Single-valued or point estimates of monitoring costs are presented, but should be regarded with some caution because:

- information received from individual plants varied in detail so that some cost estimates may have significant ranges;

- there is some flexibility as to how individual plants will actually implement some of the monitoring requirements;

- effluent quality differs from plant-to-plant and from pipe-to-pipe in the inorganic chemical sector. Therefore, the number of parameters to be monitored between plants and pipes varies.

For the above reasons, ranges of costs are estimated for some monitoring functions where possible.

The cost of analytical testing was estimated by assuming that all analytical testing will be performed by commercial laboratories. This assumption allows for comparable cost estimates for each of the plants within the sector.

All cost estimates are expressed in current dollars.

## 1.6 Pre-Regulation Consultation and Meetings

Industry representatives from the inorganic chemical sector spent time at meetings and review committees in order to participate in the development of the regulations.

Industry representatives spent an estimated 191 person-days in meetings with the Sector Joint Technical Committee (JTC) and its Analytical and Regulation Subcommittees. In addition, the inorganic chemical sector companies report that about 165 person-days were expended over 12-months to undertake pre-regulation monitoring tasks. In total, 356 person-days were required for pre-regulation assessments, consultation and meetings. This figure is likely an underestimate, since it has been assumed, in the absence of any estimate, that each plant spent a minimum of 10 person-days on these activities.

# 2.0 MONITORING COST ESTIMATES

## 2.1 Regulation Requirements

The General Effluent Monitoring Regulation specifies requirements for five major monitoring activities which each wastewater discharger must implement to various degrees and levels of effort.

1. Sampling requirements (section 3)
2. Analytical requirements (characterization and routine analyses) (section 4)
3. Toxicity testing (section 5)
4. Flow measurement (section 6)
5. Reporting (section 7)

Seven types of "sampling points" or effluent streams are defined in the specific Regulation for the inorganic chemical sector.

1. Process effluent
2. Combined effluent
3. Batch discharge
4. Once-through cooling water
5. Waste disposal site effluent (leachate)
6. Stormwater
7. Emergency overflow

As shown in Table 2.1, the predominant stream types in this sector are combined and stormwater effluents.

In developing the regulation, the Inorganic Chemical Sector Joint Technical Committee (JTC) considered the cost-effectiveness of the requirements.

Due to the diversity of processes within the sector, plant and stream-specific monitoring requirements were developed. This is in contrast to the petroleum refining sector, wherein each plant must test for the same compounds at the same frequency, but in accordance with the remaining sectors.

Table 2.1

## Inorganic Chemical Sector
## Number and Type of Effluent Streams Per Plant

| | Company/Plant | P | C | B | O | L | S | E | TOTAL |
|---|---|---|---|---|---|---|---|---|---|
| | | Effluent Stream | | | | | | | |
| A | Albright & Wilson Americas Inc. | | 1 | | | | 1 | | 2 |
| B | Allied Chemicals Canada Inc. | 3 | | | | | 3 | | 6 |
| C | Cabot Canada Ltd. | | 1 | | | | | 1 | 2 |
| D | CIL Inc.- Cornwall | 1 | 1 | | | | | | 2 |
| E | CIL Inc.- Courtright | 1 | 7 | 1 | 2 | | | | 11 |
| F | Columbian Chemicals Canada Ltd. | | | | | | 2 | | 2 |
| G | Cyanamid Canada Inc.- Niagara Plant | | 2 | | | | | | 2 |
| H | Cyanamid Canada Inc.- Welland Plant | | 2 | | | | 8 | | 10 |
| I | Explosive Technologies International | | 1 | | | | 2 | | 3 |
| J | Electro Minerals (Canada) Inc. | | 2 | | | | 6 | | 8 |
| K | The Exolon-ESK Company of Canada Ltd. | | 1 | | | | | | 1 |
| L | Fiberglas Canada Inc. | | 1 | | | 1 | | | 2 |
| M | General Chemical Canada Ltd. | | 3 | | | | | | 3 |
| N | IMC Ltd. | | 1 | | | | | | 1 |
| O | Nitrochem Inc. | | 1 | | | | | | 1 |
| P | Norton Advanced Ceramics of Canada Inc. | | 4 | | | | 1 | | 5 |
| Q | Partek Insulations Ltd. | | 1 | | | | 3 | | 4 |
| R | Stanchem | | | 1 | | | | | 1 |
| S | Sulco Chemicals Limited | | 1 | | | | 1 | | 2 |
| T | Union Carbide Canada Ltd. | | 2 | | 1 | 1 | 2 | | 6 |
| U | Washington Mills Limited | | 1 | | | | 1 | | 2 |
| V | Welland Chemical Ltd. | | | 2 | 3 | | | | 5 |
| | TOTAL | 5 | 33 | 4 | 6 | 2 | 30 | 1 | 81 |

Legend: P=process C=combined B=batch discharge O=once-through cooling water
L=waste disposal site (leachate) S=stormwater E=emergency overflow

Source: Inorganic Sector Monitoring Regulation

## 2.2 Sampling Requirements

Sampling protocols and specifications are defined in Section 3 of the "Effluent Monitoring - General" regulation.

"Sampling" involves taking effluent samples from designated sampling points, collecting the samples, storing them under refrigeration where necessary, and then transporting them to laboratory facilities within a prescribed time period.

While commercial laboratory prices are assumed, many plants have indicated that they will likely perform some analyses in-house. This could lower estimated analytical costs, but could also increase estimated capital costs. In fact, it is possible that in-house analyses increase both analytical costs and capital costs.

It is assumed that each plant will need to dedicate a vehicle for the collection of samples within the plant. A new van costs about $18,000 to buy or $6,000 per year to lease. Assuming the vehicle travels 10,000 km/year at a government rate of $.275/km., the annual operating cost would be $2,750/plant. If the truck is leased, the annual operating cost would be $8,750 with no capital.

In addition, the vehicle will also have to deliver daily samples to the commercial laboratory. Taking the round trip distance between each plant and a designated commercial laboratory (assumed to be located in Toronto), the additional annual operating cost per plant could range from $14,000 to $85,000 assuming a rate of $0.275/km. This may be an over-estimate, since most if not all plants will do daily sampling in-house (F. Ryan, MISA).

Assuming the truck is leased, total annual operating costs for the collection and transportation of samples can range from about $23,000 to $94,000. For some plants, these are likely to be overestimates of the operating costs as indicated by the range of cost estimates provided by industry representatives, shown in Table 2.6.

The regulations further require that samples be stored at a temperature no higher than 10°C, and they must be prevented from freezing. Therefore, each plant will require refrigeration equipment to store samples. Some plants may require more than one refrigerator due to the large number of samples taken and therefore may be able to take advantage of economies-of-scale.

A cost of $2,500 is assumed for each refrigerator to store samples.

Refrigeration equipment is also required to house automatic composite samplers. The cost of these units are usually included in the capital and installation costs of the automatic samplers.

Table 2.2 indicates which plants have currently installed or will require automatic sampling devices and refrigerators for the storage of samples and samplers.

Automatic flow-proportional samplers, including refrigerators, cost between $7,000 and $10,000. Installation costs, which include temperature recorders, electrical supply, signal cables and construction, are sensitive to site-specific circumstances, and can be more than twice the equipment cost.

Estimates of the capital costs of sampling were provided by fifteen plants whose estimates ranged from $0 to $150,000, as shown in Table 2.7. For those plants which did not submit their own estimates, a minimum capital cost of $12,500 consisting of $2,500 for a refrigerator and $10,000 for an automatic sampler, was assumed.

In total, based on the foregoing discussion, sampling costs for the inorganic chemical sector should be in the order of about $700 thousand. This compares to the total costs for sampling activities, as provided by industry representatives and any working assumptions, which are estimated to range from about $4,000 to $107,000 per year per plant, totaling about $2.1 million for the whole sector. These point estimates are shown in Tables 2.6 and 2.7.

The broad range of these estimates among the plants reflects the differing sampling requirements among sector firms. It is possible that the definition of "sampling costs" vary from plant to plant, and may or may not incorporate all the components discussed above. It is also possible that some firms have not yet properly assessed any additional expenditures required to meet MISA regulations.

Table 2.2

## Inorganic Chemical Sector
## Monitoring Devices Required By Plant

| | Company/Plant | Sampling Devices | Refrig- erators | Flow Monit. Devices |
|---|---|---|---|---|
| A | Albright & Wilson Americas Inc. | 1 | 1 | 0 |
| B | Allied Chemicals Canada Inc. | 1 | 1 | 1 |
| C | Cabot Canada Ltd. | 1 | 1 | 0 |
| D | CIL Inc.- Cornwall | 1 | 1 | 1 |
| E | CIL Inc.- Courtright | 1 | 1 | 1 |
| F | Columbian Chemicals Canada Ltd. | 0 | 0 | 0 |
| G | Cyanamid Canada Inc.- Niagara Plant | 1 | 1 | 0 |
| H | Cyanamid Canada Inc.- Welland Plant | 1 | 1 | 0 |
| I | Explosive Technologies International | 1 | 1 | 1 |
| J | Electro-Minerals (Canada) Inc. | 1 | 1 | 0 |
| K | The Exolon-ESK Company of Canada Ltd. | 1 | 1 | 0 |
| L | Fiberglas Canada Inc. | 1 | 1 | 0 |
| M | General Chemical Canada Ltd. | 1 | 1 | 0 |
| N | IMC Ltd. | 1 | 1 | 0 |
| O | Nitrochem Inc. | 1 | 1 | 0 |
| P | Norton Advanced Ceramics of Canada Inc. | 1 | 1 | 0 |
| Q | Partek Insulations Ltd. | 1 | 1 | 0 |
| R | Stanchem | 0 | 0 | 0 |
| S | Sulco Chemicals Limited | 1 | 1 | 0 |
| T | Union Carbide Canada Ltd. | 1 | 1 | 0 |
| U | Washington Mills Limited | 1 | 1 | 0 |
| V | Welland Chemical Ltd. | 1 | 1 | 1 |
| | TOTAL | 20 | 20 | 5 |

Legend: "1" = plant will require a suitable device(s)
"0" = plant has a suitable device(s)

Source: MOE, Water Resources Branch, 1989

## 2.3 Characterization Analyses

Characterization is the quantitative determination of individual organic and inorganic parameters from the sector list which is a subset of EMPPL. Its purpose is to detect non-routine, frequently occurring contaminants with greater than 99% probability of success.

Each inorganic chemical sector plant will have to characterize its process, combined effluents and batch discharge streams for 147 chemicals listed on the Inorganic Chemical Sector list. To the extent that specific parameters are already routinely tested, additional characterization analyses will not be required. For those parameters which do require characterization analyses, the Sector Regulation (Section 5) specifies two testing frequencies on a site-specific basis.

To accommodate differences among sector plants and to utilize cost-effectiveness in the requirements, the sector was divided into two sub-categories for characterization purposes. The frequencies in each sub-category are based on the following considerations (Inorganic Chemical Sector Regulation, Section XII):

- number of product types manufactured at a site
- process complexity
- process variability
- product/raw material type
- availability of relevant historical characterization data
- past and current environmental performance

Sub-category A involved simple process, sites required to perform two characterizations per year. Sub-category B, the complex process sites, must perform four characterizations per year. Firms per category are shown in Table 5 of the Technical Rationale for the sector-specific monitoring regulation.

As noted earlier, it is assumed that characterization, toxicity testing, and routine analyses will be performed by commercial laboratories, even though some plants have the ability to conduct many of the analyses on-site. This has been done in order to obtain comparable cost estimates for each of the plants.

Commercial laboratory test prices are listed in Table 2.3 and are based on a survey of thirty-five such Canadian and U.S. border state commercial laboratories (Dillon, 1988). The 27 test groups listed contain about 150 individual chemicals. In addition, open scans (organic/elemental) must be carried out on each set of samples. The laboratories surveyed include commercial, private, municipal and institutional facilities.

These prices do not account for volume discounts. However, they also do not reflect substantial price increases some labs have instituted during the last six months. These two opposing biases probably tend to cancel each other out.

Prices of laboratory tests include quality assurance/quality control (QA/QC) samples and the preparation of required reports, but does not include transport, which was discussed in Section 2.1.

Table 2.4 summarizes characterization analyses costs, excluding transportation, per plant. Total annual characterization costs amount to about $365,000 for the inorangic chemical sector. These costs are over and above the routine analytical costs.

These cost estimates do not include pre-regulation characterization analyses, which are estimated by industry to be about $300,000 for the inorganic chemical sector (Inorangic Chemical Sector Representatives). Pre-regulation monitoring is not explicitly required by the Regulations.

## 2.4 Routine Analyses

Routine analyses involve testing of samples taken at four frequency levels - daily, three times per week, weekly and monthly, plus on an event basis for certain sampling points such as emergency overflow.

Two additional grab samples are required from waste disposal sites and stormwater effluents between January and May in order to estimate the environmental impact of snow-melt conditions. The incremental cost of these two additional samples are estimated to be about $30,000 for the sector.

Each plant has its own specific monitoring requirements under the regulations because of the

## TABLE 2.3

## AVERAGE ONTARIO COMMERCIAL LABORATORY PRICES FOR ANALYTICAL TEST GROUPS

| ANALYTICAL TEST GROUP | | AVERAGE PRICE |
|---|---|---|
| 1 | Chemical Oxygen Demand (COD) | $29.78 |
| 2 | Cyanide | $36.10 |
| 3 | Hydrogen Ion (pH) | $6.84 |
| 4 | Nitrogen | $86.99 |
| 5 | Organic Carbon (DOC) | $57.03 |
| 6 | Total Phosphorus | $25.12 |
| 7 | Specific Conductance | $9.44 |
| 8 | Suspended Solids (TSS/VSS) | $14.87 |
| 9 | Total Metals | $84.10 |
| 10 | Hydrides | $23.33 |
| 11 | Chromium (Hexavalent) | $20.47 |
| 12 | Mercury | $25.77 |
| 13 | Total Alkyl Lead | $172.00 |
| 14 | Phenolics (4AAP) | $42.93 |
| 15 | Sulphide | $29.80 |
| 16 | Volatiles, Halogenated | $239.90 |
| 17 | Volatiles, Non-Halogenated | $176.81 |
| 18 | Volatiles, Water Soluble | $126.50 |
| 19 | Extractables, Base Neutral | $427.49 |
| 20 | Extractables, Acid (Phenolics) | $245.68 |
| 21 | Extractables, Phenoxy Acid Herbicides * | $188.09 |
| 22 | Extractables, Organochlorine Pesticides * | $270.14 |
| 23 | Extractables, Neutral-chlorinated | $232.04 |
| 24 | Chlorinated Dibenzo-p-dioxins and Dibenzofurans | $1,228.27 |
| 25 | Solvent Extractables (oil & grease) | $36.00 |
| 26 | Fatty and Resin Acids | $133.18 |
| 27 | PCBs (Total) | $103.90 |
| IC1 | Chloride | $23.58 |
| IC2 | Fluoride | $24.92 |
| IC3 | Sulphate | $24.33 |
| -- | Gas Chromatography and Mass Spectrometry Open Scans | $850.00 |

* Does not apply to the Inorganic Chemical Sector

Source: M.M.Dillon, "Inventory and Critical Review of Laboratory Resources", July 1988; MOE, Water Resources Branch, 1989

Table 2.4

### Inorganic Chemical Sector
### Analytical Requirements - Operating Costs
### ($000's)

| | | Routine Analyses | | | | | % of Total | Character-ization | TOTAL ANALYT |
|---|---|---|---|---|---|---|---|---|---|
| | Company/Plant | Daily | 3/Week | Weekly | Monthly | TOTAL | (Rout) | Analyses * | REQ'S |
| A | Albright & Wilson Americas Inc. | 20.5 | 0.0 | 10.6 | 6.7 | 37.8 | 2% | 7.5 | 45.3 |
| B | Allied Chemicals Canada Inc. | 22.7 | 187.4 | 13.2 | 25.7 | 249.0 | 10% | 31.4 | 280.4 |
| C | Cabot Canada Ltd. | 11.4 | 16.8 | 14.8 | 15.4 | 58.4 | 2% | 6.7 | 65.1 |
| D | CIL Inc.- Cornwall | 41.6 | 47.3 | 31.8 | 22.2 | 142.9 | 6% | 22.0 | 164.9 |
| E | CIL Inc.- Courtright | 467.1 | 90.4 | 48.6 | 30.8 | 636.9 | 27% | 101.0 | 737.9 |
| F | Columbian Chemicals Canada Ltd. | 0.0 | 0.0 | 0.0 | 17.5 | 17.5 | 1% | 0.0 | 17.5 |
| G | Cyanamid Canada Inc.- Niagara Plant | 22.7 | 11.3 | 18.2 | 15.7 | 67.9 | 3% | 13.1 | 81.0 |
| H | Cyanamid Canada Inc.- Welland Plant | 104.6 | 40.7 | 15.7 | 62.8 | 223.8 | 9% | 16.9 | 240.7 |
| I | Explosive Technologies International | 11.4 | 0.0 | 10.7 | 9.4 | 31.5 | 1% | 7.6 | 39.1 |
| J | Electro Minerals (Canada) Inc. | 22.7 | 0.0 | 23.2 | 19.3 | 65.2 | 3% | 15.5 | 80.7 |
| K | The Exolon-ESK Company of Canada Inc. | 11.4 | 0.0 | 10.5 | 0.2 | 22.1 | 1% | 7.8 | 29.9 |
| L | Fiberglas Canada Inc. | 27.0 | 8.9 | 10.8 | 6.6 | 53.3 | 2% | 7.4 | 60.7 |
| M | General Chemical Canada Ltd. | 22.7 | 36.3 | 31.9 | 7.0 | 97.9 | 4% | 14.2 | 112.1 |
| N | IMC Ltd. | 29.6 | 3.8 | 10.8 | 15.1 | 59.3 | 2% | 5.3 | 64.6 |
| O | Nitrochem Inc. | 43.1 | 0.0 | 40.6 | 25.0 | 108.7 | 5% | 4.7 | 113.4 |
| P | Norton Advanced Ceramics of Canada Inc. | 45.5 | 43.2 | 43.1 | 5.7 | 137.5 | 6% | 30.7 | 168.2 |
| Q | Partek Insulations Ltd. | 11.4 | 19.8 | 12.0 | 15.8 | 59.0 | 2% | 22.4 | 81.4 |
| R | Stanchem | 11.4 | 78.8 | 9.6 | 2.8 | 102.6 | 4% | 6.5 | 109.1 |
| S | Sulco Chemicals Limited | 11.4 | 66.4 | 12.8 | 8.9 | 99.5 | 4% | 7.0 | 106.5 |
| T | Union Carbide Canada Ltd. | 22.7 | 14.9 | 16.8 | 18.4 | 72.8 | 3% | 16.9 | 89.7 |
| U | Washington Mills Limited | 11.4 | 7.5 | 10.5 | 3.3 | 32.7 | 1% | 7.8 | 40.5 |
| V | Welland Chemical Ltd. | 0.0 | 0.0 | 0.0 | 5.4 | 5.4 | 0% | 12.9 | 18.3 |
| | TOTAL | 972.3 | 673.5 | 396.2 | 339.7 | 2,381.7 | 100% | 365.3 | 2,747.0 |

* Characterization plus Open Characterization costs.

Source: Inorganic Chemical Sector Monitoring Regulation variety of processes and contaminants found from plant to plant. The number and costs of routine monitoring therefore vary from plant to plant.

As seen in Table 2.4, the annual cost of routine analyses range between $5,400 and $637,000 per plant per year. The total point estimate for all 22 plants amounts to $2.4 million per year. These estimates exclude transportation.

## 2.5 Toxicity Testing

Biological toxicity testing consists of acute lethality tests of the static 96-hour rainbow trout toxicity test and a 48-hour *Daphnia magna* (a small water flea) mortality test.

Process, combined effluents and batch streams which are final discharge points will be tested monthly while once-through cooling water will be tested quarterly.

If three consecutive monthly trout tests result in mortality for no more than two out of ten fish, trout tests for the remaining 9 months can be carried out on a pass/fail basis. Similarly, if the first quarterly results for once-through cooling water have no more than 20% mortality for the fish, the remaining three tests on trout and *Daphnia magna* may be carried out on a pass/fail basis. This provision does not apply to the *Daphnia magna* test on process, combined and batch effluents, which must be tested monthly.

Table 2.5 displays the maximum and minimum number of toxicity tests that could be required annually at each plant for final discharge points including once-through cooling water.

Toxicity testing costs are based on the following prices for full dilution series:

|  |  |
|---|---|
| Trout: | $360 per test |
| Daphnia: | $240 per test |
|  | $600 per test |

Toxicity testing costs for trout on a pass/fail basis are $225 per test.

These prices do not include costs of collecting samples and transport to a laboratory. Based on the experience of some plants in the Organic

Table 2.5

## Inorganic Chemical Sector
## Toxicity Testing Costs
## ($)

| | | Number of Tests | | Costs* | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | Trout | | Daphnia | TOTAL | |
| | Company/Plant | Trout | Daph | Max | Min | | Max | Min |
| A | Albright & Wilson Americas Inc. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| B | Allied Chemicals Canada Inc. | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| C | Cabot Canada Ltd. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| D | CIL Inc.- Cornwall | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| E | CIL Inc.- Courtright | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| F | Columbian Chemicals Canada Ltd. | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| G | Cyanamid Canada Inc.- Niagara Plant | 24 | 24 | 8,640 | 6,210 | 5,760 | 14,400 | 11,970 |
| H | Cyanamid Canada Inc.- Welland Plant | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| I | Explosive Technologies International | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| J | Electro-Minerals (Canada) Inc. | 36 | 36 | 12,960 | 9,315 | 8,640 | 21,600 | 17,955 |
| K | The Exolon-ESK Company of Canada Ltd. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| L | Fiberglas Canada Inc. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| M | General Chemical Canada Ltd. | 24 | 24 | 8,640 | 6,210 | 5,760 | 14,400 | 11,970 |
| N | IMC Ltd. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| O | Nitrochem Inc. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| P | Norton Advanced Ceramics of Canada Inc. | 48 | 48 | 17,280 | 12,420 | 11,520 | 28,800 | 23,940 |
| Q | Partek Insulations Ltd. | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| R | Stanchem | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| S | Sulco Chemicals Limited | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| T | Union Carbide Canada Ltd. | 16 | 16 | 5,760 | 7,245 | 3,840 | 9,600 | 11,085 |
| U | Washington Mills Limited | 12 | 12 | 4,320 | 3,105 | 2,880 | 7,200 | 5,985 |
| V | Welland Chemical Ltd. | 36 | 36 | 12,960 | 9,315 | 8,640 | 21,600 | 17,955 |
| | TOTAL | 352 | 352 | 126,720 | 94,185 | 84,480 | 211,200 | 178,665 |

* Trout = $360/test (acute lethality)
= $225/test (pass/fail)

[ Difference (max-min): $32,535 ]

Daphnia = $240/test

Source: Inorganic Chemical Sector Monitoring Regulations, Section 15

Chemical Manufacturing Sector, these additional costs can be as much as $100 per test (OCM Industry Representatives, 1988).

The total cost of this function assuming that the maximum number of toxicity tests have to be carried out during the 12-month period amounts to $211,200 as shown in Table 2.5. If the minimum number of fish toxicity tests were carried out for all plants, the total annual cost for toxicity testing would be $178,665, a difference of $32,535.

## 2.6 Flow Measurement

Flow measurement is necessary to determine total loadings of contaminants discharged to the environment. Chemical analyses reveal concentrations (mass/volume). Flow is measured in volume/unit time. The product of concentration and flow is mass/unit time (e.g.,kg/d), the measure of loadings.

Primary and secondary flow measurement devices are required to achieve the accuracy specified for the process and combined sampling points. Table 2.2 indicates that at least five plants will require primary and secondary flow measurement devices. The number required at each plant can vary from approximately one to ten.

Installation costs will vary among plants due to site-specific characteristics such as the volume of effluent flow, location of pipes, etc.

Flow measurement accuracy requirements are a function of stream type. Continuous flow measurement at an accuracy of +/-5% for the primary element and +/-2% of full scale for the secondary element is required for process effluents, and an accuracy of +/-20% is required for all other stream types.

Estimated operating costs of flow measurement provided by industry representatives range from $0 to $5,000 as shown in Table 2.6. As above, in order to supplement for missing information it was assumed that a nominal amount of $1,000 per year would be expended for flow measurement operating costs.

Industry representatives were asked to provide estimated capital expenditures for flow measurement and these estimates range from $0 to $250,000 as shown in Table 2.7.

In order to supplement estimates for those plants which did not provide estimates, it was assumed that the capital costs for flow measurement would be $10,000 per year for those plants with five effluent streams or less, and $20,000 per year for those plants with greater than five effluent streams. While these figures are somewhat arbitrary, they are not out of line with estimates provided by other sources.

In a report done for MOE, Gore and Storrie (1987) correlates flow rates and estimated pipe sizes to the costs of different new flow measurement devices. For example, an in-line magnetic flow meter may cost an average of $6,700 for a 6" pipe, and up to $40,600 for a 48" pipe. These costs could be underestimates, since there may be additional installation costs.

These ranges may reflect the fact that some plants already have adequate flow measurement installations.

## 2.7 Reporting

Monitoring data will have to be assembled, recorded, stored, and reported to company management and to the Ministry of the Environment.

Data storage and manipulation will require an AT personal computer together with compatible peripherals and software, plus personnel dedicated to perform report generation functions.

Cost estimates for reporting were supplied by plants and vary greatly, from $0 up to $20,000, totaling about $78,000 for the inorganic chemical sector. These differences appear to be due to the availability of existing facilities. For those plants from whom no estimates were received, a nominal annual operating cost of $1,000 is assumed. Cost estimates for reporting are displayed in Tables 2.6 and 2.7.

## 2.8 Intake Water

Another potential sampling point is intake water. The Inorganic Chemical Sector Regulations do not require monitoring requirements for intake water. However, many plants who obtain water from large surfacewater sources which in turn receive wastewater discharges of other municipalities and industrial plants are currently sampling and testing intake water. Data on intake water quality would permit the firms to determine net loadings of contaminants generated by the plant. Most inorganic chemical sector plants will likely monitor intake water, and cost estimates are presented in this report for comparative purposes.

Eight plants provided specific estimates of intake water monitoring costs ranging from $4,900 to $30,000. The total aggregate cost of intake monitoring for the sector, as estimated by the eight plants, is estimated at $124,000.

## 2.9 Total Estimated Costs of the MISA Inorganic Chemical Sector Monitoring Requirements

Table 2.6 presents a summary of the operating cost estimates for each monitoring function. The total operating costs of compliance are estimated to be about $4.5 million, and will be incurred over the 12-month tenure of the monitoring Regulation.

Table 2.7 shows that the total capital costs of compliance are estimated to be about $1.2 million.

The point-estimates of the total incremental costs (rounded to millions of dollars) based on the monitoring functions in the Inorganic Chemical Sector site-specific schedules for the twenty-two plants are as follows:

| | |
|---|---|
| Sampling | $2.1 million |
| Characterization | $0.4 million |
| Routine Monitoring | $2.4 million |
| Toxicity Testing | $0.2 million |
| Flow Measurement | $0.7 million |
| Reporting | $0.1 million |

The total point-estimate of the monitoring cost for this sector of the MISA related requirements is about $5.7 million. This does not include estimated intake water monitoring costs.

These cost estimates are subject to varying degrees of uncertainty. Using an uncertainty measure of +/- 20%, the total costs of the regulation requirements could range from $4.6 million to $6.9 million.

Total operating and capital costs for the inorganic chemical sector of complying with MISA monitoring requirements are summarized in Table 2.8.

Table 2.6

Inorganic Chemical Sector
Summary of Incremental Operating Costs
By Monitoring Function
($000's)

| | Company/Plant | Sampling | Characterization | Routine | Toxicity Testing | Flow Measurement | Reporting | TOTAL OPERATING COSTS | % Of Total |
|---|---|---|---|---|---|---|---|---|---|
| A | Albright & Wilson Americas Inc. | 31.3 | 7.5 | 37.8 | 7.2 | 1.0 | 1.0 | 85.8 | 2% |
| B | Allied Chemicals Canada Inc. | 85.0 | 31.4 | 249.0 | 0.0 | 1.0 | 1.0 | 367.4 | 8% |
| C | Cabot Canada Ltd. | 50.0 | 6.7 | 58.4 | 7.2 | 1.0 | 1.0 | 124.3 | 3% |
| D | CIL Inc.- Cornwall | 94.1 | 22.0 | 142.9 | 7.2 | 1.0 | 1.0 | 268.2 | 6% |
| E | CIL Inc.- Courtright | 481.0 | 101.0 | 636.9 | 7.2 | 5.0 | 5.0 | 1,236.1 | 27% |
| F | Columbian Chemicals Canada Ltd. | 22.8 | 0.0 | 17.5 | 0.0 | 1.0 | 1.0 | 42.3 | 1% |
| G | Cyanamid Canada Inc.- Niagara Plant | 36.9 | 13.1 | 67.9 | 14.4 | 0.0 | 6.2 | 138.5 | 3% |
| H | Cyanamid Canada Inc.- Welland Plant | 10.2 | 16.9 | 223.8 | 7.2 | 1.0 | 2.3 | 261.4 | 6% |
| I | Explosive Technologies International | 35.4 | 7.6 | 31.5 | 7.2 | 0.0 | 4.6 | 86.3 | 2% |
| J | Electro Minerals (Canada) Inc. | 56.0 | 15.5 | 65.2 | 21.6 | 0.0 | 5.0 | 163.3 | 4% |
| K | The Exolon-ESK Company of Canada Ltd. | 65.0 | 7.8 | 22.1 | 7.2 | 0.0 | 0.0 | 102.1 | 2% |
| L | Fiberglas Canada Inc. | 5.0 | 7.4 | 53.3 | 7.2 | 5.0 | 1.0 | 78.9 | 2% |
| M | General Chemical Canada Ltd. | 157.0 | 14.2 | 97.9 | 14.4 | 0.0 | 5.0 | 288.5 | 6% |
| N | IMC Ltd. | 8.9 | 5.3 | 59.3 | 7.2 | 0.0 | 1.0 | 81.7 | 2% |
| O | Nitrochem Inc. | 76.0 | 4.7 | 108.7 | 7.2 | 1.0 | 1.0 | 198.6 | 4% |
| P | Norton Advanced Ceramics of Canada Inc. | 34.8 | 30.7 | 137.5 | 28.8 | 1.0 | 1.0 | 233.8 | 5% |
| Q | Partek Insulations Ltd. | 67.0 | 22.4 | 59.0 | 7.2 | 1.0 | 1.0 | 157.6 | 3% |
| R | Stanchem | 94.0 | 6.5 | 102.6 | 7.2 | 1.0 | 1.0 | 212.3 | 5% |
| S | Sulco Chemicals Limited | 60.0 | 7.0 | 99.5 | 7.2 | 0.0 | 0.0 | 173.7 | 4% |
| T | Union Carbide Canada Ltd. | 24.0 | 16.9 | 72.8 | 9.6 | 5.0 | 6.0 | 134.3 | 3% |
| U | Washington Mills Limited | 25.0 | 7.8 | 32.7 | 7.2 | 0.0 | 2.5 | 75.2 | 2% |
| V | Welland Chemical Ltd. | 1.5 | 12.9 | 5.4 | 21.6 | 0.0 | 0.0 | 41.4 | 1% |
| | TOTAL | 1,520.9 | 365.3 | 2,381.7 | 211.2 | 25.0 | 47.6 | 4,551.7 | 100% |

Notes:

Estimates not provided by plants B,D,F,O,P,Q,R.

For those plants who did not provide cost estimates, assumptions were made:

- -Sampling costs include leasing 1 vehicle @$8,750 plus transporation to a lab in Toronto.
- -Flow measurement and reporting costs of $1,000 each.

Source: Inorganic Sector Representatives; Inorganic Sector Monitoring Regulation

Table 2.7

Inorganic Chemical Sector
Summary of Incremental Capital Costs
By Monitoring Function
($000's)

| | Company/Plant | Sampling | Characterization | Routine | Toxicity Testing | Flow Measurement | Reporting | TOTAL CAPITAL COSTS | % Of Total |
|---|---|---|---|---|---|---|---|---|---|
| A | Albright & Wilson Americas Inc. | 12.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 12.0 | 1% |
| B | Allied Chemicals Canada Inc. | 12.5 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 32.5 | 3% |
| C | Cabot Canada Ltd. | 12.5 | 0.0 | 0.0 | 0.0 | 60.0 | 0.0 | 72.5 | 6% |
| D | CIL Inc.- Cornwall | 12.5 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 22.5 | 2% |
| E | CIL Inc.- Courtright | 150.0 | 0.0 | 0.0 | 0.0 | 250.0 | 15.0 | 415.0 | 35% |
| F | Columbian Chemicals Canada Ltd. | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 10.0 | 1% |
| G | Cyanamid Canada Inc.- Niagara Plant | 62.5 | 0.0 | 0.0 | 0.0 | 30.0 | 0.0 | 92.5 | 8% |
| H | Cyanamid Canada Inc.- Welland Plant | 32.0 | 0.0 | 0.0 | 0.0 | 31.0 | 0.0 | 63.0 | 5% |
| I | Explosive Technologies International | 32.5 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 42.5 | 4% |
| J | Electro Minerals (Canada) Inc. | 15.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 15.0 | 1% |
| K | The Exolon-ESK Company of Canada Ltd. | 10.0 | 0.0 | 0.0 | 0.0 | 10.0 | 5.0 | 25.0 | 2% |
| L | Fiberglas Canada Inc. | 40.0 | 0.0 | 0.0 | 0.0 | 60.0 | 5.0 | 105.0 | 9% |
| M | General Chemical Canada Ltd. | 13.0 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 23.0 | 2% |
| N | IMC Ltd. | 2.5 | 0.0 | 0.0 | 0.0 | 0.0 | 1.0 | 3.5 | 0% |
| O | Nitrochem Inc. | 12.5 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 22.5 | 2% |
| P | Norton Advanced Ceramics of Canada Inc. | 12.5 | 0.0 | 0.0 | 0.0 | 20.0 | 0.0 | 32.5 | 3% |
| Q | Partek Insulations Ltd. | 12.5 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 22.5 | 2% |
| R | Stanchem | 0.0 | 0.0 | 0.0 | 0.0 | 10.0 | 0.0 | 10.0 | 1% |
| S | Sulco Chemicals Limited | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0% |
| T | Union Carbide Canada Ltd. | 82.5 | 0.0 | 0.0 | 0.0 | 75.0 | 4.0 | 161.5 | 14% |
| U | Washington Mills Limited | 7.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 7.5 | 1% |
| V | Welland Chemical Ltd. | 2.5 | 0.0 | 0.0 | 0.0 | 1.0 | 0.1 | 3.6 | 0% |
| | TOTAL | 537.0 | 0.0 | 0.0 | 0.0 | 627.0 | 30.1 | 1,194.1 | 100% |

Notes:

Estimates not provided by plants B,D,F,O,P,Q,R.

For those plants who did not provide cost estimates, assumptions were made:

-Sampling costs of $12,500 to include 1 refrigerator @$2,500 and 1 sampler @$10.000

-Flow measurement costs: plants with 0-5 streams @$10,000; plants With >5 streams @$20,000

Source: Inorganic Sector Representatives; Text

## 2.10 Alternative Estimates of Routine Monitoring Costs

In order to place these cost estimates in an analytical context, estimates of routine analyses costs under an alternative set of assumptions have been developed.

The Inorganic Chemical Sector Regulation involves plant and effluent-specific requirements and schedules. If, however, the Regulation was applied in a manner similar to the petroleum refining sector, subject inorganic chemical plants would be required to adhere to a single across-the-board monitoring requirement.

Using this scenario, an alternative set of routine analyses costs were estimated based on the following assumptions:

1. Inorganic chemical manufacturing sector plants subject to the MISA regulations would have to routinely monitor all of their effluent streams for a maximum number of contaminants.
2. "Maximum requirements" are defined as the most stringent requirements for a single plant applied under the currently proposed regulations.

As shown in Table 2.9, this "stringent" scenario resulted in routine monitoring costs ranging from $0.3 million to $3.1 million per plant, and $23.1 million for the entire sector, as compared to the total estimated routine costs, shown in Table 2.4, of $2.4 million.

Although the implications of this scenario for other monitoring functions were not calculated, it is possible that costs associated with characterization analyses, for example, could be reduced for some plants.

In summary, if each plant in the inorganic chemical sector had been subject to a common set of analytical requirements, as was the petroleum refining sector, total routine monitoring costs could total approximately $21.4 million. This is $19.1 million more than the point estimate of the routine analyses costs required by the Regulation.

This difference of $19.1 million can be reviewed as a measure of the cost-effectiveness of the pipe-specific approach in the proposed regulation

Table 2.8

Inorganic Chemical Sector
Total Incremental Monitoring Costs
($000's)

| | Company/Plant | Total Operating Costs | Total Capital Costs | TOTAL | % of Total |
|---|---|---|---|---|---|
| A | Albright & Wilson Americas Inc. | 85.8 | 12.0 | 97.8 | 2% |
| B | Allied Chemicals Canada Inc. | 367.4 | 32.5 | 399.9 | 7% |
| C | Cabot Canada Ltd. | 124.3 | 72.5 | 196.8 | 3% |
| D | CIL Inc.- Cornwall | 268.2 | 22.5 | 290.7 | 5% |
| E | CIL Inc.- Courtright | 1,236.1 | 415.0 | 1,651.1 | 29% |
| F | Columbian Chemicals Canada Ltd. | 42.3 | 10.0 | 52.3 | 1% |
| G | Cyanamid Canada Inc.- Niagara Plant | 138.5 | 92.5 | 231.0 | 4% |
| H | Cyanamid Canada Inc.- Welland Plant | 261.4 | 63.0 | 324.4 | 6% |
| I | Explosive Technologies International | 86.3 | 42.5 | 128.8 | 2% |
| J | Electro Minerals (Canada) Inc. | 163.3 | 15.0 | 178.3 | 3% |
| K | The Exolon-ESK Company of Canada Ltd. | 102.1 | 25.0 | 127.1 | 2% |
| L | Fiberglas Canada Inc. | 78.9 | 105.0 | 183.9 | 3% |
| M | General Chemical Canada Ltd. | 288.5 | 23.0 | 311.5 | 5% |
| N | IMC Ltd. | 81.7 | 3.5 | 85.2 | 1% |
| O | Nitrochem Inc. | 198.6 | 22.5 | 221.1 | 4% |
| P | Norton Advanced Ceramics of Canada Inc. | 233.8 | 32.5 | 266.3 | 5% |
| Q | Partek Insulations Ltd. | 157.6 | 22.5 | 180.1 | 3% |
| R | Stanchem | 212.3 | 10.0 | 222.3 | 4% |
| S | Sulco Chemicals Limited | 173.7 | 0.0 | 173.7 | 3% |
| T | Union Carbide Canada Ltd. | 134.3 | 161.5 | 295.8 | 5% |
| U | Washington Mills Limited | 75.2 | 7.5 | 82.7 | 1% |
| V | Welland Chemical Ltd. | 41.4 | 3.6 | 45.0 | 1% |
| | TOTAL | 4,551.7 | 1,194.1 | 5,745.8 | 100% |

Source: Tables 2.6 and 2.7

for the inorganic chemical sector. MOE has been cognizant of the potential financial implications of the MISA requirements, and has incorporated such considerations in the development of policy initiatives without a significant loss of technical data.

Table 2.9

## Inorganic Chemical Sector
## Alternative Routine Monitoring Cost Estimate
## ($000's)

| | Company/Plant | Inorganic Sector Regulation | Stringent Scenario | Difference(*) | |
|---|---|---|---|---|---|
| | | | | $ | % |
| A | Albright & Wilson Americas Inc. | 37.8 | 523.0 | 485.2 | 93% |
| B | Allied Chemicals Canada Inc. | 249.0 | 1,830.7 | 1,581.7 | 86% |
| C | Cabot Canada Ltd. | 58.4 | 523.0 | 464.6 | 89% |
| D | CIL Inc.- Cornwall | 142.9 | 523.0 | 380.1 | 73% |
| E | CIL Inc.- Courtright | 636.9 | 2,876.7 | 2,239.8 | 78% |
| F | Columbian Chemicals Canada Ltd. | 17.5 | 523.0 | 505.5 | 97% |
| G | Cyanamid Canada Inc.- Niagara Plant | 67.9 | 523.0 | 455.1 | 87% |
| H | Cyanamid Canada Inc.- Welland Plant | 223.8 | 2,615.2 | 2,391.4 | 91% |
| I | Explosive Technologies International | 31.5 | 784.6 | 753.1 | 96% |
| J | Electro Minerals (Canada) Inc. | 65.2 | 2,092.2 | 2,027.0 | 97% |
| K | The Exolon-ESK Company of Canada Inc. | 22.1 | 261.5 | 239.4 | 92% |
| L | Fiberglas Canada Inc. | 53.3 | 523.0 | 469.7 | 90% |
| M | General Chemical Canada Ltd. | 97.9 | 523.0 | 425.1 | 81% |
| N | IMC Ltd. | 59.3 | 261.5 | 202.2 | 77% |
| O | Nitrochem Inc. | 108.7 | 261.5 | 152.8 | 58% |
| P | Norton Advanced Ceramics of Canada Inc. | 137.5 | 1,307.6 | 1,170.1 | 89% |
| Q | Partek Insulations Ltd. | 59.0 | 1,046.1 | 987.1 | 94% |
| R | Stanchem | 102.6 | 261.5 | 158.9 | 61% |
| S | Sulco Chemicals Limited | 99.5 | 523.0 | 423.5 | 81% |
| T | Union Carbide Canada Ltd. | 72.8 | 1,569.1 | 1,496.3 | 95% |
| U | Washington Mills Limited | 32.7 | 523.0 | 490.3 | 94% |
| V | Welland Chemical Ltd. | 5.4 | 1,569.1 | 1,563.7 | 100% |
| | TOTAL | 2,381.7 | 21,444.8 | 19,063.1 | 89% |

* The difference represents the cost-effectiveness of implementing pipe-specific monitoring requirements.

Source: Table 2.4; Inorganic Chemical Sector Monitoring Regulations

## 3.0 ECONOMIC EFFECTS AND IMPLICATIONS OF MONITORING COSTS

### 3.1 Method

The monitoring costs incurred by the firms under the MISA regulations will increase operating expenses and, unless there is some offsetting increase in productivity associated with wastestream monitoring, profits to the firms and returns on the particular operation may be reduced.

In this section, some of the key effects of these costs on the inorganic chemical sector as a whole, and where possible, on individual firms within the sector will be examined.

The sectoral analysis will examine how these extra costs may impact on international and provincial competitiveness, employment and profitability.

Using publicly available data, assessments of the implications of the MISA monitoring costs to the sector, and individual firm where possible, is made in relation to the following financial performance measures:

- capital expenditures;
- after-tax income (loss);
- rate of return on capital employed;
- rate of return on total assets; and
- employment.

Ideally, the impacts of the incremental costs of monitoring should be analyzed against the projected future values of the above-mentioned financial measures. However, because such projections are unavailable, the costs have been assessed against historical data over the period 1981-1987. In order to reflect the business cycle over this period, the MISA monitoring costs will also be assessed against the highest year and the lowest year for the same financial measures.

Monitoring costs are assumed to impact the company in the following ways:

- operating costs of monitoring will increase the firm's annual operating expenses and are fully deductible from after-tax earnings;

- capital costs would normally be depreciated over 3 to 5 years. Only a proportion of the capital costs should, therefore, be deducted from profits or earnings each year. However, to be conservative, it will be assumed that capital costs are fully deducted in the 12-month period.

Full deduction of the extra operating and capital costs from after-tax earnings or profits overestimates the impact because depreciation and an offsetting reduction in income taxes (resulting in an increase in after-tax profits) is ignored.

Financial data are seldom available at the plant level although it is at this level that financial consequences will usually influence decisions or affect the viability of an operation. Assessments and comparisons will generally have to be made against consolidated company data which are publicly available. In addition, the majority of the firms in this sector are privately owned and therefore do not publish annual financial reports.

Only eight firms within the inorganic chemical sector actually publish annual reports.

For some firms a limited amount of disaggregated data on the chemicals segments of their businesses are published. These data will be used to supplement the analyses based on consolidated company data where possible.

## 3.2 State of the Industry and Outlook

The inorganic chemical sector in Canada and Ontario is discussed in the industry profile entitled "The Economic and Financial Profile of the Ontario Inorganic Chemicals Industry" by Woods Gordon Management Consultants (August 1987) and through various publications from the Canadian Chemical Producers' Association (CCPA).

Inorganic chemicals are distinguished from organic chemicals because, they do not generally contain carbon as a principle element and are derived from materials in the earth's crust, such as minerals, metals, and salt. The industry is primarily engaged in the production of bulk or commodity chemicals such as chlor-alkalies, acids, inorganic compounds and rare earth metal salts. Major products include sulphuric acid, soda ash, phosphorus, chlorine and caustic soda. Inorganic chemical products are important in the production processes for pulp and paper, textile processing, fertilizers, paints and detergents.

The inorganic chemical industry is a fairly small, but growing part of the Canadian chemicals industry. It accounted for 12% or $2.2 billion in chemical and chemical products industry shipments in 1985, about 12.6% in 1986 and 12.7% in 1987 (DRIE 1987). Additional shipments of inorganic chemicals are accounted for by establishments that are primarily engaged in the productions of organic chemicals and products.

Most of the data on individual inorganic chemical producers in Ontario and Canada are usually aggregated within broader financial data for the multinational or multi-product firms that represent a major share of the industry. Many of the firms within this sector do not produce publicly available financial statistics.

Firms in the industry tend to be capital intensive. Firms subject to the MISA monitoring requirements collectively expended over $170 million on capital expenditures between 1981 and 1987.

Many of the firms are vertically integrated and foreign-controlled.

The Ontario inorganic chemical industry is a net exporter, accounting for about 60% of industry shipments, primarily to the United States. The U.S. market is very competitive, with many U.S. based and foreign firms selling the same products or close substitutes. The Canadian market is also competitive, with the price for commodities heavily influenced by the export market.

This dependence on the export market and the low ability to affect the international pricing makes it difficult for Ontario producers to pass on cost increases in the form of higher prices unless all the other firms are subject to the same costs. Twenty-two of the approximately 36 establishments in Ontario are direct dischargers of effluent into provincial waterways and are therefore initially subject to MISA monitoring costs.

As with other industries, chemical plants are facing increasingly stringent environmental controls in virtually all other jurisdictions. Chemical firms in the United States must operate under "Best Practical Technology" (BPT) Effluent Limitation Guidelines.

While it is difficult to compare inter-jurisdictional environmental standards and their requirements, it is fair to say that most industrialized nations are imposing similar, if not more stringent, pollution control requirements with respect to air, water, and waste.

The inorganic chemical industry is recovering from the recession of the early 1980's. The industry has done a lot of cost cutting since the 1982 recession, allowing value-added for the industry to remain flat despite the low business cycle. Input costs in the form of relatively low natural gas prices and stable electricity cost increases have also assisted the industry in its recovery.

Modest growth is expected for the inorganic chemical industry through 1991.

Among the industries that purchase inorganic chemicals, the auto industry is expected to show slow growth in North America, although a greater use of plastic and ceramic parts could offset some of the negative implications for inorganic chemical sales. The pulp and paper sector is expected to perform well over the next decade, while the agricultural sector demand for chemicals could be affected by a forecast of continuing financial difficulties facing farmers.

The effect of the Canada-U.S. Free Trade Agreement (FTA) on the inorganic chemical industry is uncertain. Exports of inorganic chemicals to the United States represented about 30% ($1.1 billion) of 1987 chemical and chemical product exports from Canada.

## 3.3 Sectoral Economic Impact

In this section "sector" is defined as the 22 inorganic chemical plants subject to the MISA monitoring requirements, and "industry" as all the inorganic chemical producers in Canada and Ontario.

Financial data for the sector is publicly available for only eight firms. As shown in Table 3.1, these eight firms account for 12 of the 22 plants in the sector through ownership. Where possible, therefore, the incremental costs of monitoring of individual plants have been aggregated and then assessed in relation to financial indicators of the parent company for which financial data are available.

Table 3.1

Inorganic Chemical Sector
Selected Financial Statistics For Firms With Available Financial Data
($000's)

| Sch | Company | Statistic | 1981 | 1982 | 1983 | 1984 | 1985 | 1986 | 1987 | Average |
|---|---|---|---|---|---|---|---|---|---|---|
| B | Allied Chemicals Canada Inc. | Net Income | 98,387 | 14,001 | 5,395 | 21,827 | 19,545 | -- | -- | 31,831 |
| M | | Capital Expends | 20,817 | 17,524 | 10,363 | 13,559 | 13,101 | -- | -- | 15,073 |
| | | Ret on Cap Emp | 15.7% | 9.1% | 6.4% | 12.1% | 13.7% | -- | -- | 11.8% |
| | | Ret on Assets | 30.6% | 5.8% | 3.6% | 9.4% | 7.1% | -- | -- | 12.1% |
| D | C-I-L Inc. | Net Income | 49,166 | 13,686 | 26,417 | 35,000 | 18,000 | (12,000) | 40,000 | 24,324 |
| E | | Capital Expends | 130,600 | 87,000 | 109,000 | 118,000 | 118,000 | 53,000 | 40,000 | 93,657 |
| R | | Ret on Cap Emp | 9.4% | 6.7% | 5.3% | 6.4% | 7.3% | 6.0% | 7.8% | 6.9% |
| | | Ret on Assets | 7.0% | 5.0% | 4.4% | 4.9% | 3.9% | 1.8% | 5.9% | 4.6% |
| G | Cyanamid Canada Inc. | Net Income | 10,097 | 1,843 | 2,403 | 12,257 | 6,689 | (4,566) | -- | 4,787 |
| H | | Capital Expends | 27,635 | 31,476 | 19,231 | 13,944 | 10,628 | 14,583 | -- | 19,583 |
| | | Ret on Cap Emp | 7.2% | 1.3% | 1.7% | 7.8% | 4.2% | -2.8% | -- | 3.2% |
| | | Ret on Assets | 5.9% | 0.9% | 1.1% | 5.3% | 3.3% | -2.0% | -- | 2.3% |
| K | The Exolon-ESK Company of Canada Ltd. | Net Income | (40) | (511) | (116) | 347 | (1,098) | (204) | -- | (270) |
| | | Capital Expends | 240 | 274 | 249 | 910 | 5,361 | 1,453 | -- | 1,415 |
| | | Ret on Cap Emp | -7.0% | -10.6% | -2.5% | 6.8% | -14.5% | -3.1% | -- | -4.7% |
| | | Ret on Assets | -5.0% | -6.9% | -1.5% | 3.7% | -7.1% | -1.3% | -- | -2.5% |
| L | Fiberglas Canada Inc. | Net Income | 15,914 | 9,142 | 17,232 | 14,773 | 20,670 | -- | -- | 15,546 |
| | | Capital Expends | 9,259 | 6,303 | 9,749 | 15,910 | 16,011 | -- | -- | 11,446 |
| | | Ret on Cap Emp | 21.4% | 10.5% | 13.8% | 12.9% | 17.1% | -- | -- | 17.3% |
| | | Ret on Assets | 13.6% | 8.6% | 11.3% | 9.6% | 12.3% | -- | -- | 11.0% |
| O | Nitrochem Inc. | Net Income | 1,081 | (856) | (5,893) | (2,914) | (1,767) | (1,667) | -- | (2,003) |
| | | Capital Expends | 2,019 | 1,827 | 1,308 | 1,031 | 1,240 | 4,804 | -- | 2,038 |
| | | Ret on Cap Emp | 6.6% | 16.5% | -4.5% | 10.0% | 14.5% | 11.9% | -- | 11.5% |
| | | Ret on Assets | 9.2% | 9.4% | -1.8% | 5.4% | 8.7% | 7.2% | -- | 6.2% |
| P | Norton Advanced Ceramics of Canada Inc. | Net Income | 2,820 | 1,914 | 1,586 | 2,951 | -- | -- | -- | 2,318 |
| | | Capital Expends | 375 | 409 | 718 | 1,201 | -- | -- | -- | 676 |
| | | Ret on Cap Emp | 20.2% | 16.0% | 8.7% | 18.7% | -- | -- | -- | 15.6% |
| | | Ret on Assets | 14.0% | 11.9% | 7.1% | 13.7% | -- | -- | -- | 11.6% |
| T | Union Carbide Canada Ltd. | Net Income | -- | (17,907) | (1,439) | (28,193) | (89,641) | 47,497 | 31,490 | (9,699) |
| | | Capital Expends | -- | 118,571 | 57,951 | 50,042 | (90,474) | 67,740 | (21,232) | 30,433 |
| | | Ret on Cap Emp | -- | 8.0% | 3.2% | 4.6% | 4.6% | 7.2% | 8.6% | 4.6% |
| | | Ret on Assets | -- | 0.7% | 2.7% | 0.1% | -8.6% | 10.8% | 8.2% | 2.1% |

Legend:

Net Income = after-tax earning(loss)
Capital Expends = capital expenditures
Ret on Cap Emp = return on capital employed
Ret on Assets = return on total assets

Source: Company Annual Reports

Table 3.2 details the impact of the MISA cost of monitoring on four financial indicators: capital expenditures, net after-tax income (loss), and the rates of return on capital employed and total assets.

Return on capital employed is a measure firms use to assess competing investment opportunities. It is defined by Woods Gordon as:

$$\frac{\text{net income - extraordinary items + interest}}{\text{total assets - current liabilities}}$$

The incremental capital costs of monitoring did not significantly affect the ratio for any of the plants or the sector. Average ratios would have been reduced by 1% or less.

The average annual capital expenditure for the inorganic chemical sector from 1981-1987 was over $170 million. The capital costs of monitoring for each of the eight firms represent 0.37% to 4.81% of average annual capital expenditures. If the monitoring regulations were in effect for the years for the highest level of capital expenditures, the capital costs of monitoring would have represented 0.27% to 2.71% of their capital expenditures.

The impact of incremental operating costs due to monitoring represent 0.51% to 10.09% of after-tax income of five of the eight firms. Three of the firms posted after-tax losses so that the imposition of additional costs would have increased their losses by 1.51% to 37.77%. In their most profitable years, the operating costs of monitoring would have represented anywhere from 0.31% to 29.42% of net income.

The rate of return on total assets corresponds to the operating profit margin. Like other rate of returns measures, it measures the effectiveness with which the firm's assets are deployed. The rate of return on total assets is defined by Woods Gordon as:

$$\frac{\text{net income + interest}}{\text{total assets}}$$

The incremental operating costs of monitoring represent a less than 1% change in the rate of return on total assets for all eight firms for which financial data are publicly available.

The inorganic chemical sector employs over 3,800 people in Ontario. This represents about two thirds of Ontario industry levels. The MISA monitoring costs are not expected to affect these employment levels, but may in fact enhance employment opportunities in the form of consultants, analytical laboratories, and equipment manufacturers.

The incremental monitoring costs are not expected to adversely affect the international competitiveness of the firms in the inorganic chemical sector since monitoring accounts for a small fraction of the aggregate industry costs and profits, and because the bulk of the monitoring costs will be incurred during one year.

Demand, sales and earnings for the inorganic chemical sector performed better in 1987 over 1986. While 1988 levels did not rise as dramatically, the sector on the whole is in better shape than financial statistics for 1981-1986 indicate. It is estimated that monitoring costs would have a smaller impact over the next 12-24 months than they would if they were incurred in previous years.

## 3.4 Financial Analyses of Selected Inorganic Chemical Sector Firms

Financial statistics are publicly available for the following firms. Table 3.2 displays the impact of MISA monitoring costs of these firms.

### Allied Chemical Canada Inc./General Chemical Canada Ltd.

Allied Chemicals Canada is a wholly owned subsidiary of Allied Signal Canada. At the end of 1985, operations at Allied's Amherstburg complex were split between Allied and General Chemical Canada. As a result, financial statistics for General Chemical are not available. The monitoring costs of MISA are therefore assessed against the financial statistics of Allied prior to the reorganization, and thus include the costs of monitoring to be incurred by both firms.

In 1984, chemical products accounted for about 66% of Allied's net income. Sales rose 8.4% in 1985, after steadily declining between 1981-1984.

The Allied and General Chemical plants subject to MISA currently employ about 600 people.

The capital costs of monitoring represent 0.37% of average capital expenditures, and would reduce the average rate of return on capital employed by only 0.2%. The operating costs of monitoring would have reduced average after-tax income of 2.06%, and changed the average rate of return on total assets by 0.14%.

### C-I-L Inc.

C-I-L incurs MISA related costs through three plants in the inorganic chemical sector; the two C-I-L plants at Cornwall and Courtright, and Stanchem, which is a Division of C-I-L.

C-I-L is also subject to MISA monitoring costs associated with the organic chemical manufacturing sector. These other sector costs have been estimated to be $135.6 thousand.

The company has been hurt in recent years by the slowdown in the agriculture, mining and petroleum sectors, however it rebounded from a loss of $12 million in 1986 to a net profit of $40 million in 1987. C-I-L is optimistic, and considers itself to be in a good position for a market upturn (Company Annual Report, 1987).

In C-I-L's Forest Products and Polymers Group, increased selling prices of inorganic chemicals and other efficiencies pushed operating profit in 1987 solidly over 1986 (Company Annual Report, 1987).

Stanchem is hailed as Canada's largest chemical distributer, packaging and selling a wide range of products to markets in all sectors of the Canadian economy. In March 1987, Stanchem bought a dimethyl ether plant in Ajax, Ontario becoming the only Canadian producer of DMO, an environmentally safe propellant.

Stanchem sales and operating profit in 1987 were also above 1986 levels.

The aggregated MISA monitoring costs for the three C-I-L-owned plants represent 0.48% of average capital expenditures and 7.06% of average annual after-tax income.

The C-I-L cost estimate of the incremental costs associated with MISA were substantially higher than estimates provided by any of the other sector plants. MOE is currently seeking clarification and further cost breakdowns in order to ascertain the validity of the C-I-L estimates.

Ratio analyses indicate a negligible impact of the rates of return of capital employed and total assets.

## Cyanamid Canada Inc.

Cyanamid has two plants in this sector, both in Niagara Falls. Together, these plants employ about 600 people.

This firm produces agricultural, chemical and medical products of which the chemical segment comprises about one third of total sales. A net loss of 1986 was primarily a result of a poor showing in the agricultural sector. The chemical products division experienced an increase in the operating profits of almost 50% in 1986 although sales stayed flat.

The incremental capital costs of monitoring would be 0.79% of average annual capital expenditures, and just over 1% of lowest year of such expenditures. Average after-tax income would have been reduced by 8.35% by the operating costs of monitoring.

The ratio analyses indicate a negligible impact of 0.1% each.

## The Exolon-ESK Company of Canada Inc.

The Canadian plant has posted losses in all years except 1984, even though sales rose by 12.8% in 1986. It employs about 150 people. According to the 1986 Annual Report of its parent company, Exolon-ESK Company (U.S.), higher volumes in 1986 were offset by price declines in the company's major product lines.

Because of a series of net losses, the incremental operating costs of monitoring would have increased average losses by 37.77%. Capital expenditures rose significantly in 1985 and 1986 over previous years. The capital costs of monitoring represent 1.77% of average annual capital expenditures.

The rate of return on capital employed would have been reduced by 1.03% by the capital monitoring costs, and the rate of return on total assets would have changed by 0.55% due to the imposition of incremental operating costs of monitoring.

### Fiberglas Canada Inc.

The company has been consistently profitable, even during the recession in 1982, and is well capitalized. It has an average annual growth in sales of about 9% since 1982, and posted very good returns on capital employed and assets.

Fiberglas has an average debt to equity ratio of about 1:3.5, sufficient to increase return on equity by earning profits on borrowed funds at a higher rate than that paid to the lender while maintaining an acceptable level of financial risk.

Total capital expenditures between 1981 and 1985 were about $57 million, equal to 40% of cash generated from operations.

The plant subject to MISA employs 455 people.

Monitoring costs represent only 0.92% of average annual capital expenditures and 0.51% of average after-tax income. Ratio analyses indicate virtually no impact.

### Nitrochem Inc.

In 1985, the chemicals and fertilizers segment which operates in Canada, experienced an increase in operating profits before interest of 45% and accounted for 84% of net sales. The explosives business, centred in the United States, has performed poorly by comparison, and has been a main contributor to Nitrochem's poor overall results.

The company has been posting a net loss since 1982, and the incremental operating costs of MISA therefore would have increased average net losses by 9.92%.

Conversely, capital expenditures in 1986 rose by $3.6 million over 1986. The capital costs of monitoring thus represent 1.1% of average capital expenditures, and only 0.47% of the 1986 level of investment.

The average rate of return on capital employed would have changed by only 0.47%, and the average rate of return on total assets by 0.25%.

The Nitrochem plant subject to MISA employs 175 people.

## Norton Advanced Ceramics of Canada Inc.

Norton Company, the U.S. parent, operates in Canada through Norton Canada Inc., but also produces at Canadian plants owned either directly or through another subsidiary. In spite of a declining abrasives industry, Norton was profitable for the years 1981-1985.

The company was reorganized in 1985, and financial statistics are not available for subsequent years. The plant subject to MISA employs 225 people.

Annual capital expenditures equalled about 22% of cash generated from operations. Although the MISA monitoring costs are therefore not very useful when compared against Norton Canada's financial statistics, they are the only indicators available. Average capital expenditures would have been reduced by 4.81% and average after-tax income by 10.09%.

Ratio analyses indicate a less than 1% impact.

## Union Carbide Canada Ltd.

Union Carbide produces plastics, chemicals, industrial medical and specialty gases and carbon products to serve primarily industrial customers. In 1985, Union Carbide sold its polyethylene business to Novacor Chemicals, and in 1986, divested itself of its consumer products operations.

Sales were up by 17% in 1987 after remaining flat in 1986. This increase took place entirely in the plastics and chemicals division which posted sales of $140 million in 1986 and $200 million in 1987. Operating profits doubled to $18.5 million in 1987. Sales and profits attributed to gases and carbon (inorganic chemicals) experienced no growth in 1987 although this division accounts for 60% of operating profits.

The plant subject to MISA employs 600 people.

The strong posting of net income in 1986 and 1987 resulted in an average net loss of just under $10 million. The incremental operating costs of monitoring would have further increased this amount by 1.51%. In the high profit year of 1986, net income would have been reduced by only 0.31%.

Capital expenditures for Union Carbide seem to be on a roller coaster. However, the capital costs of monitoring constitute only 0.53% of average capital expenditures.

The rates of return on capital employed and total assets would have both been reduced by only 0.01%.

Table 3.2

## Inorganic Chemical Sector
## Impact of Monitoring Costs On Selected Financial Indicators

| | | CAPITAL EXPENDITURES | | | AFTER-TAX INCOME (LOSS) | | | RATE OF RETURN ON CAPITAL EMPLOYED | | | RATE OF RETURN ON TOTAL ASSETS | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Monitoring Capital Cost as a % of Annual Capital Expenditures | | | Monitoring Operating Cost as a % of Annual After-Tax Income (Loss) | | | Change in Ratio due to Monitoring Operating Cost | | | Change in Ratio due to Monitoring Operating Cost | | |
| | Company/Plant | Average Year | Highest Year | Lowest Year | Average Year | Highest Year | Lowest Year | Average Year | Highest Year | Lowest Year | Average Year | Highest Year | Lowest Year |
| A | Albright & Wilson Americas Inc. * | | | | | | | | | | | | |
| B | Allied Chemicals Canada Inc. | 0.37% | 0.27% | 0.54% | 2.06% | 0.67% | 12.16% | -0.20% | -0.14% | -0.20% | -0.14% | -0.13% | -0.15% |
| C | Cabot Canada Ltd. * | | | | | | | | | | | | |
| D | CIL Inc.- Cornwall ) | 0.48% | 0.34% | 1.12% | 7.06% | 3.49% | -14.30% | -0.12% | -0.13% | -0.12% | -0.09% | -0.13% | -0.07% |
| E | CIL Inc.- Courtright ) | | | | | | | | | | | | |
| F | Columbian Chemicals Canada Ltd. * | | | | | | | | | | | | |
| G | Cyanamid Canada Inc.- Niagara Plant ) | 0.79% | 0.49% | 1.07% | 8.35% | 3.26% | -8.76% | -0.15% | -0.15% | -0.17% | -0.11% | -0.13% | -0.11% |
| H | Cyanamid Canada Inc.- Welland Plant ) | | | | | | | | | | | | |
| I | Explosive Technologies International * | | | | | | | | | | | | |
| J | Electro Minerals (Canada) Inc. * | | | | | | | | | | | | |
| K | The Exolon-ESK Company of Canada Ltd. | 1.77% | 0.47% | 10.42% | -37.77% | 29.42% | -9.30% | -1.03% | -1.17% | -0.81% | -0.55% | -0.63% | -0.41% |
| L | Fiberglas Canada Inc. | 0.92% | 0.66% | 1.67% | 0.51% | 0.38% | 0.86% | -0.04% | -0.01% | -0.01% | -0.02% | -0.03% | -0.03% |
| M | General Chemical Canada Ltd. ** | | | | | | | | | | | | |
| N | IMC Ltd. * | | | | | | | | | | | | |
| O | Nitrochem Inc. | 1.10% | 0.47% | 2.18% | -9.92% | 18.37% | -3.37% | -0.47% | -0.50% | -0.63% | -0.25% | -0.30% | -0.23% |
| P | Norton Advanced Ceramics of Canada Inc. | 4.81% | 2.71% | 8.67% | 10.09% | 7.92% | 14.74% | -0.88% | -0.78% | -0.76% | -0.66% | -0.71% | -0.58% |
| Q | Partek Insulations Ltd. * | | | | | | | | | | | | |
| R | Stanchem *** | | | | | | | | | | | | |
| S | Sulco Chemicals Limited * | | | | | | | | | | | | |
| T | Union Carbide Canada Ltd. | 0.53% | 0.14% | -0.18% | -1.51% | 0.31% | -0.16% | -0.01% | -0.01% | -0.01% | -0.01% | -0.05% | -0.01% |
| U | Washington Mills Limited * | | | | | | | | | | | | |
| V | Welland Chemical Ltd. * | | | | | | | | | | | | |

Notes:

* Financial data not available

** Part of Allied Chemicals Canada until end of 1985

*** Stanchem is a Division of CIL

Source: Table 2.8 and Table 3.1

# 4.0 CONCLUSIONS AND RECOMMENDATIONS

## 4.1 Conclusions

Incremental capital and operating costs of monitoring for the inorganic chemical sector range from $30.6 thousand up to $1.7 million. Point estimates for individual firms are estimated to vary by +/- 20%.

Based on comparisons of the estimated monitoring costs of the proposed Regulation with potential costs under a more "stringent scenario", the proposed plant and effluent-specific regulations are far more cost-effective. Routine analyses of the current proposed site-specific regulations are $19.1 million less than the more stringent scenario.

The economic impacts of the estimated monitoring costs on the inorganic chemical sector are small in relation to aggregate sectoral financial indicators.

For the individual firms subject to the MISA monitoring requirements, the impacts are varied. An added difficulty in assessing probable impacts is the lack of not only plant-specific data, but an absence of publicly available financial information at a corporate level.

Impacts on annual average after-tax income (loss) range from a reduction in net income ranging from 0.51% to 10.09%, and an increase in net loss ranging from 1.51% to 37.77%.

The inorganic industry is recovering from the 1982 recession, but not as strongly as other players in the chemical and chemical products industry. Growth in this industry is expected to remain moderate in the medium term.

Despite a modest financial forecast, the industry may be able reap benefits from the monitoring requirements. Firms may gain goodwill and be seen by the public as being sensitive to clearly stated public concerns about the degradation of the environment by industry.

Internationally, firms can be seen as sound corporate players. Other jurisdictions which are not as environmentally astute as Ontario are expected to become increasingly sensitive. Firms in those jurisdictions will likely have to expend even more funds in order to meet expected requirements.

The need to meet the MISA and other initiatives may also make firms more competitive by improving and/or changing processes and input requirements. The monitoring requirements may also enhance employment opportunities for consultants, analytical laboratories and equipment manufacturers.

Finally, the imposition of monitoring requirements is another step in controlling the release of contaminants to our environment.

## 4.2 Recommendations

The foregoing analyses indicate that the financial impacts of the monitoring regulations on plants within the inorganic chemical sector can be varied. In order to identify possible problems at an early stage, it is recommended that the MOE also monitor the actual incremental capital and operating costs of the monitoring activities during the tenure of the Regulations. Early identification of possible financial burdens will enable MOE and the individual plant to review and assess workable solutions.

MOE must also examine the impact of the MISA monitoring requirements on those firms who are responsible for plants in more than one industrial sector. Examples of such firms include C-I-L and Domtar.

Also, at the end of the regulation period, each plant should attempt to record and report the actual incremental costs incurred due to the MISA monitoring requirements in order to:

- validate and improve the cost-estimation procedures used in this report.

- monitor and assess the financial and employment impacts of the monitoring requirements, especially on individual plants.

- help to determine the full financial impact of the MISA requirements when the costs of the limits regulations are determined.

Finally, when monitoring data and activities at these plants (and other industrial dischargers) are audited by MOE personnel or their agents, information should be gathered to determine whether the monitoring activities or data have been, or could be, helpful in making the operations or processes more efficient and productive.

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